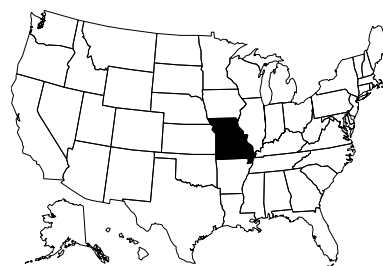


MISSOURI

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Program Description

The overall aquatic biological assessment program for Missouri streams and Wadeable rivers is a multi-agency collaborative effort between the Missouri Department of Conservation (MDC), the Missouri Department of Natural Resources (MDNR), The University of Missouri-Columbia, and the USEPA. The overall program involves a Resource Assessment and Monitoring Program, biological criteria development, monitoring of targeted sites to determine compliance with the designated use of aquatic life protection in the standards, monitoring for 303(d) purposes, and the development of a stream classification system framework.

The Resource Assessment and Monitoring Program is committed to sampling 120 sites per year beginning in 2002. These sites are a combination of targeted reference sites and randomly selected sites. The MDC is responsible for fish sampling, physical habitat assessment, and water quality contaminant sampling (to be analyzed by the USEPA). The MDNR is responsible for sampling macroinvertebrates at 30% of the sites. For the remainder of the sites, samples are collected by MDC and analyzed by the University of Missouri-Columbia. The Resource Assessment and Monitoring Program operates on a five year cycle with statewide random sites collected for one year and random sites in priority watersheds collected for four years. Data will be used to report on the status of Missouri's streams and Wadeable rivers.

The MDNR initiated biological criteria development for Wadeable, perennial streams in 1992. Numeric biocriteria for one trophic level (macroinvertebrate communities) were completed in February 2002. This effort also involved the cooperation of the University of Missouri-Columbia, School of Natural Resources and the Missouri Resource Assessment Partnership. Future biological criteria efforts will add an additional trophic level (fish communities) to Wadeable, perennial streams and will initiate a low level effort to develop numeric criteria for other size ranges of streams and rivers. The numeric criteria and associated components have been used to evaluate compliance with the designated use of aquatic life protection as well as in the assessment of biological communities for 303(d) purposes.

The Missouri Resource Assessment Partnership is an interagency partnership that provides expertise in geographic information systems, remote sensing, and natural resource management. Since 1997, the Missouri Resource Assessment Partnership has been in the process of developing a hierarchical classification framework for Missouri's stream resources. This framework is expected to provide the foundation for biological study designs in the Resource Assessment and Monitoring Program, biological criteria, and targeted studies concerning the designated use of aquatic life protection and 303(d) purposes.

Documentation and Further Information

Methodology for the 2002 303(d) list, 1998 303(d) list, and Missouri's Water Quality Standards and criteria are all available on the MDNR Water Pollution Control Program homepage: <http://www.dnr.state.mo.us/deq/wpcp/homewpccp.htm>

Fischer, S.A. 2002. *Resource Assessment and Monitoring Program: Standard Operating Procedures - fish sampling*. Missouri Department of Conservation, Columbia, MO.

Sarver, R., S. Harlan, C. Rabeni, and S. Sowa. 2001. *Draft Report - Biological Criteria for Wadeable/Perennial Streams of Missouri*. Prepared by Missouri Department of Natural Resources, Air and Land Protection Division, Environmental Services Program.

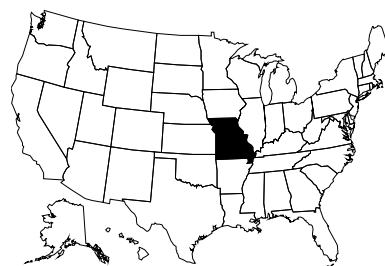
Also available through MDNR: *Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure* (2001); *Stream Habitat Assessment Project Procedure* (2000); *Macroinvertebrate Levels of Taxonomy SOP/FSS/209* (1998); *Biological Criteria for Streams of Missouri - A Final Report to the MO Department of Natural Resources*, University of Missouri, Cooperative Fish and Wildlife Unit; *Quality Control Procedures for Data Processing* (2001) MDNR/WQMS/214.

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Programmatic Elements

| | | |
|---|-------------------------------------|---|
| Uses of bioassessment within overall water quality program | <input checked="" type="checkbox"/> | problem identification (screening) |
| | <input checked="" type="checkbox"/> | nonpoint source assessments |
| | <input checked="" type="checkbox"/> | monitoring the effectiveness of BMPs |
| | <input checked="" type="checkbox"/> | ALU determinations/ambient monitoring |
| | <input checked="" type="checkbox"/> | promulgated into state water quality standards as biocriteria |
| | <input type="checkbox"/> | support of antidegradation |
| | <input checked="" type="checkbox"/> | evaluation of discharge permit conditions (<i>MDNR only</i>) |
| | <input checked="" type="checkbox"/> | TMDL assessment and monitoring |
| Applicable monitoring designs | <input type="checkbox"/> | other: |
| | <input checked="" type="checkbox"/> | targeted (i.e., sites selected for specific purpose) (<i>comprehensive use throughout jurisdiction by MDNR</i>) |
| | <input type="checkbox"/> | fixed station (i.e., water quality monitoring stations) |
| | <input checked="" type="checkbox"/> | probabilistic by stream order/catchment area (<i>comprehensive use throughout jurisdiction and in specific river basins or watersheds by MDC</i>) |
| | <input checked="" type="checkbox"/> | probabilistic by ecoregion, or statewide (<i>comprehensive use throughout jurisdiction and in specific river basins or watersheds by MDC</i>) |
| | <input checked="" type="checkbox"/> | rotating basin (<i>used in specific rivers basins or watersheds by MDNR</i>) |
| | <input checked="" type="checkbox"/> | other: reference site monitoring |

Stream Miles

Total miles **52,194**

(estimated using National Hydrography Database)

Total perennial miles 22,194

Total miles assessed for biology* **21,996**

fully supporting for 305(b) 11,519

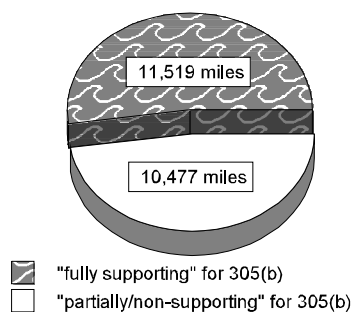
partially/non-supporting for 305(b) 10,477

listed for 303(d) n/a

number of sites sampled (*on an annual basis*) 200

number of miles assessed per site site specific (*MDC*)
0.25 (*MDNR*)

21,996 Miles Assessed for Biology



*Miles assessed for aquatic life as reported in Missouri's draft 2002 305(b) Water Quality Report are based on biological, chemical, physical and toxicological data. The status and number of stream miles assessed exclusively for biology is not readily available.

Aquatic Life Use (ALU) Designations and Decision-Making

| | |
|---|--|
| ALU designation basis | Warm Water vs. Cold Water |
| ALU designations in state water quality standards | Four designations: General Warm Water Aquatic Life, Limited Warm Water Aquatic Life, Cool Water Fisheries, and Cold Water Fisheries |
| Narrative Biocriteria in WQS | Procedures used to support narrative biocriteria located in SOPs and draft biocriteria document for wadeable/perennial streams housed at MDNR/Air and Land Protection Division, Environmental Services Program |
| Numeric Biocriteria in WQS | under development (Numeric biocriteria for macroinvertebrate communities in wadeable, perennial streams will be completed sometime in 2002. These criteria are intended for inclusion in the water quality standards during the next triennial WQS review.) |
| Uses of bioassessment data in integrated assessments with other environmental data (e.g., toxicity testing and chemical specific criteria) | <input checked="" type="checkbox"/> assessment of aquatic resources <input checked="" type="checkbox"/> cause and effect determinations <input checked="" type="checkbox"/> permitted discharges <input type="checkbox"/> monitoring (e.g., improvements after mitigation) <input type="checkbox"/> watershed based management |
| Uses of bioassessment/biocriteria in making management decisions regarding restoration of aquatic resources to a designated ALU | none |

Reference Site/Condition Development

| | |
|--|---|
| Number of reference sites | 62 total |
| Reference site determinations | <input checked="" type="checkbox"/> site-specific (<i>MDC</i>) <input type="checkbox"/> paired watersheds <input checked="" type="checkbox"/> regional (aggregate of sites) <input checked="" type="checkbox"/> professional judgment (<i>MDC</i>) <input checked="" type="checkbox"/> other: Missouri Ecologic Drainage Units/VST layer (<i>MDC</i>) |
| Reference site criteria | <p>Representative of ecoregion and stream size, and in natural condition with respect to habitat, water quality, biological integrity and diversity, watershed land use and riparian conditions</p> <p>Disturbed habitat = <75% comparable to reference (<i>MDNR</i>)</p> <p><i>MDC</i> uses R-EMAP terminology: perennial flow, relatively high heterogeneity of substrate materials, natural channel morphology, natural hydrograph, natural water color</p> |
| Characterization of reference sites within a regional context | <input type="checkbox"/> historical conditions <input checked="" type="checkbox"/> least disturbed sites <input type="checkbox"/> gradient response <input type="checkbox"/> professional judgment <input checked="" type="checkbox"/> other: minimally disturbed in the Ozarks |
| Stream stratification within regional reference conditions | <input checked="" type="checkbox"/> ecoregions (or some aggregate) <input type="checkbox"/> elevation <input checked="" type="checkbox"/> stream type (<i>MDNR</i>) <input type="checkbox"/> multivariate grouping <input type="checkbox"/> jurisdictional (i.e., statewide) <input checked="" type="checkbox"/> other: <i>MDC</i> is attempting to put reference sites into each of Missouri's 17 Ecologic Drainage Units. |
| Additional information | <input checked="" type="checkbox"/> reference sites linked to ALU <input checked="" type="checkbox"/> reference sites/condition referenced in water quality standards (<i>Sarver et al. 2001</i>) <input checked="" type="checkbox"/> some reference sites represent acceptable human-induced conditions |

Field and Lab Methods

| | | |
|---|-------------------------------------|---|
| Assemblages assessed | <input checked="" type="checkbox"/> | benthos (<i>100 - 500 samples per year; single season, multiple sites - broad coverage by MDC; multiple seasons, multiple sites - broad coverage for watershed level by MDNR</i>) |
| | <input checked="" type="checkbox"/> | fish (<i>100 - 500 samples per year; single season, multiple sites - broad coverage by MDC only</i>) |
| | <input type="checkbox"/> | periphyton |
| | <input type="checkbox"/> | other: |
| Benthos | | |
| sampling gear | | kick net, 500 micron mesh nitex bag |
| habitat selection | | multihabitat |
| subsample size | | 900 for glide/pool streams, 1200 for riffle/pool streams |
| taxonomy | | genus, species |
| Fish | | |
| sampling gear | | backpack electrofisher, pram unit (tote barge), and seines; 3/16" mesh for 12' net and 1/4" mesh for 30' net |
| habitat selection | | multihabitat |
| sample processing | | biomass - batch |
| subsample | | batch |
| taxonomy | | species |
| Habitat assessments | | visual based, quantitative measurements (<i>MDC</i>), stream width and discharge (<i>MDNR</i>); performed with bioassessments |
| Quality assurance program elements | | standard operating procedures, quality assurance plan, periodic meetings and training for biologists, sorting and taxonomic proficiency checks, specimen archival, MDNR data entry QC, certification program for bioassessment within MDC |

Data Analysis and Interpretation

| | | |
|--|-------------------------------------|---|
| Data analysis tools and methods | <input checked="" type="checkbox"/> | summary tables, illustrative graphs |
| | <input checked="" type="checkbox"/> | parametric ANOVAs |
| | <input checked="" type="checkbox"/> | multivariate analysis |
| | <input checked="" type="checkbox"/> | biological metrics (<i>aggregate metrics into index</i>) |
| | <input type="checkbox"/> | disturbance gradients |
| | <input type="checkbox"/> | other: |
| Multimetric thresholds | | |
| transforming metrics into unitless scores | | 25 th percentile of reference population (<i>MDNR</i>); some based on log 10 mean wetted width, mean proportion of reference sites, or specific percentiles (<i>MDC</i>) |
| defining impairment in a multimetric index | | cumulative score equivalent to 81% of reference condition (<i>MDNR</i>) |
| Multivariate thresholds | | |
| defining impairment in a multivariate index | | significant departure from mean of reference population (<i>MDC</i>), threshold not used by MDNR for criteria but as supporting information only |
| Evaluation of performance characteristics | <input checked="" type="checkbox"/> | repeat sampling (<i>multiple seasons and years by MDNR, annual revisits by MDC</i>) |
| | <input checked="" type="checkbox"/> | precision (<i>10% duplicates within reach by MDNR</i>) |
| | <input checked="" type="checkbox"/> | sensitivity (<i>evaluated in MDNR pilot project</i>) |
| | <input checked="" type="checkbox"/> | bias (<i>MDNR eliminated redundant metrics during pilot project, multiple techniques used by MDC</i>) |
| | <input type="checkbox"/> | accuracy |
| Biological data | | |
| Storage | | STORET (<i>MDC</i>), MS Access |
| Retrieval and analysis | | SAS (<i>MDC</i>), Programming in Visual Basics for MS Access and Sigmastat (<i>MDNR</i>) |